

What is claimed is:

1. A varactor comprising:

a substrate;

a first conductor positioned on a surface of the substrate;

5 a second conductor positioned on the surface of the substrate forming a gap between the first and second conductors;

a tunable dielectric material positioned on the surface of the substrate and within the gap, said tunable dielectric material having a top surface, at least a portion of said top surface being positioned above the gap opposite the surface of the substrate; and

10 a first portion of the second conductor extending along at least a portion of the top surface of the tunable dielectric material.

2. The varactor of claim 1, wherein:

a portion of the tunable dielectric material lies along a surface of the first conductor opposite the surface of the substrate.

3. The varactor of claim 2, wherein the first portion of the second conductor has a shape that is one of: rectangular, triangular, and trapezoidal.

4. The varactor of claim 3, wherein the tunable dielectric layer comprises one of:

barium strontium titanate, barium calcium titanate, lead zirconium titanate, lead lanthanum zirconium titanate, lead titanate, barium calcium zirconium titanate, sodium nitrate,  $\text{KNbO}_3$ ,  $\text{LiNbO}_3$ ,  $\text{LiTaO}_3$ ,  $\text{PbNb}_2\text{O}_6$ ,  $\text{PbTa}_2\text{O}_6$ ,  $\text{KSr}(\text{NbO}_3)$ ,  $\text{NaBa}_2(\text{NbO}_3)_5$ ,  $\text{KH}_2\text{PO}_4$ , and composites thereof.

5. The varactor of claim 4, wherein the substrate comprises one of:  $\text{MgO}$ , alumina ( $\text{Al}_2\text{O}_3$ ),  $\text{LaAlO}_3$ , sapphire, quartz, silicon, and gallium arsenide.

6. The varactor of claim 5, wherein: the first portion of the second conductor overlaps a portion of the first conductor.

7. The varactor of claim 3, wherein the tunable dielectric layer comprises a barium strontium titanate (BSTO) composite selected from the group of:

BSTO- $\text{MgO}$ , BSTO- $\text{MgAl}_2\text{O}_4$ , BSTO- $\text{CaTiO}_3$ , BSTO- $\text{MgTiO}_3$ , BSTO- $\text{MgSrZrTiO}_6$ , and combinations thereof.

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8. The varactor of claim 7, wherein the substrate comprises one of: MgO, alumina ( $\text{Al}_2\text{O}_3$ ),  $\text{LaAlO}_3$ , sapphire, quartz, silicon, and gallium arsenide.

9. The varactor of claim 8, wherein:  
the first portion of the second conductor overlaps a portion of the first conductor.

10. The varactor of claim 1, wherein:  
the first portion of the second conductor overlaps a portion of the first conductor.

11. The varactor of claim 1, wherein the tunable dielectric layer comprises one of:

barium strontium titanate, barium calcium titanate, lead zirconium titanate, lead lanthanum zirconium titanate, lead titanate, barium calcium zirconium titanate, sodium nitrate,  $\text{KNbO}_3$ ,  $\text{LiNbO}_3$ ,  $\text{LiTaO}_3$ ,  $\text{PbNb}_2\text{O}_6$ ,  $\text{PbTa}_2\text{O}_6$ ,  $\text{KSr}(\text{NbO}_3)$ ,  $\text{NaBa}_2(\text{NbO}_3)_5$ ,  $\text{KH}_2\text{PO}_4$ , and composites thereof.

12. The varactor of claim 1, wherein the tunable dielectric layer comprises a barium strontium titanate (BSTO) composite selected from the group of:

BSTO-MgO, BSTO-Mg $\text{Al}_2\text{O}_4$ , BSTO-Ca $\text{TiO}_3$ , BSTO-Mg $\text{TiO}_3$ , BSTO-MgSrZr $\text{TiO}_6$ , and combinations thereof.

13. The varactor of claim 1, wherein the substrate comprises one of: MgO, alumina ( $\text{Al}_2\text{O}_3$ ),  $\text{LaAlO}_3$ , sapphire, quartz, silicon, and gallium arsenide.

14. The varactor of claim 1, wherein the first conductor comprises one of: platinum, platinum-rhodium, and ruthenium oxide.

15. The varactor of claim 14, wherein the second conductor comprises one of:

gold, silver, copper, platinum, and ruthenium oxide.

16. The varactor of claim 1, wherein the second conductor comprises one of:

gold, silver, copper, platinum, and ruthenium oxide.

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